

CENG 2034 Spring 2022, OPERATING SYSTEMS PROGRAMMING ASSIGNMENT

(%5 pts as given by the syllabus)

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DUE DATE: 05.06.2022, Sunday , 23.59 (no late submission will be allowed)

RULES

- Individual or group submission of ≤ 3 students are allowed.
- **C language** and **Linux OS** must be used for the programming assignment.
- **gcc** compiler must be used.
- Upload your **C code(s)** and **readme.txt** files including build instructions and group member name, surname, student ids to DYS
- All group members will submit the same files packed as one **.zip** file with the same file name.
- Similarity check will be applied to submitted codes, therefore too similar codes will be considered as cheating, all group members will get 0 pts.

PROBLEM DEFINITION

In this homework, you are required to program **Matrix Multiplication** using threads (pthread library).

Your source code should implement three threads which perform the given below tasks:

thread1: Matrix1Reader – this thread will read the input matrix file #1 whose file name is given by the 1st command line argument.

Thread2: Matrix2Reader – this thread will read the input matrix file #2 whose file name is given by the 2nd command line argument.

Thread3: MatrixMultiplier – this thread will wait for thread1 and 2 to read the input files and then perform matrix multiplication as $\text{OutputMatrix} = [\text{Matrix1} * \text{Matrix 2}]$.

Main Process will wait the threads to finish their jobs and get the matrix multiplication result and write it to the output file whose filename is given by the 3rd command line argument.

! You have to use POSIX thread (pthread) library in Linux OS and using gcc compiler as we have covered and examined the sample codes during the course related weeks. The evaluations (compile, run, verify the results and verify the source code) of your programs will be done on this platform. Other type of submissions will directly get 0 grade.

REQUIREMENTS

1. Your program shall be able to be executed from the command line as below using 3 command line arguments:

>./hw1 <Matrix1-filename> <Matrix2-filename> <OutputFileName>

e.g.:

```
mustafa@esen-1081-linux:~/oscode/hw1$ ./hw1 matrix1a.txt matrix1b.txt outmm1ab.txt
```

2. The input matrix files shall be text files of below format:

<NumberofRows-R> <NumberofColumns-C>
<a11> <a12> <a13> <a1C>
<a21> <a22> <a23> ... <a2C>
..
<aR1> <aR2> <aR3> ... <aRC>

e.g.:

```
2 3
1 2 3
3 4 5
```

3. The output matrix files shall have the same format.

4. Along with this programming assignment description, you are given 5 test cases which includes 5 input matrix pairs and their expected output files.

Please make sure that your output files are “exactly the same” as these output files corresponding to below sample execution of our ground truth software so that you will be sure that your solution and the output format is correct.

```
./hw1 matrix1a.txt matrix1b.txt outmm1ab.txt
./hw1 matrix2a.txt matrix2b.txt outmm2ab.txt
./hw1 matrix3a.txt matrix3b.txt outmm3ab.txt
./hw1 matrix4a.txt matrix4b.txt outmm4ab.txt
./hw1 matrix5a.txt matrix5b.txt outmm5ab.txt
```

! For grading, your executables will be run by other 5 test cases and correct output will be expected from your programs.

BONUS - PROGRAMMING ASSIGNMENT ! (additional %5 bonus grade)

The Bonus Programming Assignment is implementing the same problem using **multiple processes** and **interprocess communication**.

You will need to make **three forks for three child processes** that should perform the same tasks as thread#1, thread#2 and thread#3 given above. However, the process1 and process2 should be able to provide process3 the read input matrix data and process3 should send to parent process the matrix multiplication result.

You are free to use interprocess communication techniques during the course such as pipes or shared memory etc.

Good luck!